WATER RESOURCES

Key Points

- Stream monitoring has revealed natural system variability and inherent uncertainty in established field methods. This is important in the evaluation of potential water resource effects associated with land use practices.
- Continued efforts in reconstruction of stream crossings have improved aquatic organism passage and improved stream ecosystems.
- No 6th Order Hydrologic Unit Code (HUC6) watersheds have exceeded the 60 percent upland young and open coverage threshold for hydrologic effects identified in the Forest Plan.
- Continued sampling of mercury in fish and lakes provide a good baseline to determine potential effects associated with fire as part of a long-term study.
- Long-term lake water quality monitoring has revealed a better understanding of lake characteristics and trends. Repetitive sampling strengthens the data from a single year's effort.
- Timber sale monitoring revealed that the measures currently used are sufficiently protecting water quality of open-water resources.

A. MONITORING AND EVALUATION

Forest Plan Direction

This monitoring was conducted to address Forest Plan Desired Condition: D-WS-5 Water quality, altered stream flow, and channel stability do not limit aquatic biota or associated recreational uses. Water in lakes, streams, and wetlands meets or exceeds water quality requirements and Forest Plan Desired Condition: D-WS-6 Watersheds provide an appropriate quantity, quality, and timing of water flow. Stream channels and lakeshores are stable. Stream temperatures are maintained within their natural range and are not increased by lack of shading or because of channel instability. Stream channels, including those in wetlands, are able to transport water and sediment without changing their pattern, dimension, and profile. Sensitive stream types are protected and improved. Management activities protect or promote quality of habitats that occur in the riffle areas of streams, improving stable channel characteristics.

Monitoring Conducted

<u>Stream Crossing Surveys, Restoration Projects, and Monitoring</u>
Stream crossings were historically designed to accommodate passage of flood waters without explicitly considering aquatic organism passage. Passage barriers can impact the health of a stream system by interfering with the ability of species to migrate, spawn and react to natural stresses. All new or reconstructed crossings are designed and installed to

accommodate sediment transport, debris flow, and aquatic organism passage. Existing crossings that pose a barrier to passage are identified and replaced as resources allow. During 2008, coarse level road/stream crossing surveys were performed at 219 locations as shown in Figure 2.1. The purpose of these surveys was to determine which culverts may pose problems for aquatic organism passage.

Stream monitoring reaches

Stream monitoring reaches were established to evaluate the effects of logging operations on water quality, flow timing, and the physical features of aquatic, riparian, or wetland ecosystems. During 2008 monitoring occurred at seven sites across the Forest as shown in Figure 2.2. Fluvial geomorphic measurements were taken at these cross-sections including data on bed material, bank full dimensions, and profile data. The "Wohlman" pebble count method was used to characterize the bed material sediment.

Lake Water Chemistry

Lake chemistry for two groups of lakes was monitored during the 2008 field season. The first group included ten lakes associated with the Joint Fire Science Program to investigate the effect of burning on lake chemistry. Perch were sampled for mercury, chemical parameters and physical parameters (Figure 2.3). This study began in 2004 and is planned to continue for at least another summer. The prescribed burns associated with this study have not been completed so a report has not been written. If and when burning occurs, monitoring results will be reported. A second group of eleven lakes was sampled by the Minnesota Pollution Control Agency (MPCA) for water quality.

Mercury in Fish / Lake Water

The SNF continued its 30+ year partnership with the Minnesota Department of Natural Resources (MN DNR) in providing funds to test game fish from SNF lakes for mercury and other contaminants. The data from this work are included in the Minnesota Department of Health's fish advisory database where it is accessible to public.

Forest Plan Direction

This monitoring was conducted in an attempt to address Forest Plan Objective: O-WS-8 Increase the amount of forest cover that is age 16 or older on National Forest System (NFS) land in sixth level watersheds where the total (all ownerships) combined acreage in upland open plus upland young (<16 years) forest is above or approaching 60 percent of the total watershed area.

Monitoring Conducted

Young and Open Upland Coverage

Young and open upland coverage has been identified as an indicator of potential hydrologic effects associated with land disturbance and was incorporated into the Forest Plan (2004). This coverage is continually being evaluated as part of analyzing large vegetation management projects throughout the Forest. The assumption is that the

conversion of 60 percent of the land cover from upland mature cover to young and open cover results in a modification of the runoff characteristics, mostly snowmelt, of a watershed.

Forest Plan Direction

This monitoring was conducted in an attempt to address Forest Plan Desired Condition: D-WS-4 Management activities do not reduce existing quality of surface or groundwater or impair designated uses of surface and ground water as well as Forest Plan Desired Condition: D-WS-9 Fine sediment from management activities does not adversely affect lake, stream, and wetland habitats. Macro-invertebrates are represented in the approximate proportion expected for high quality waters. Fish habitats are in good to excellent condition and are spatially distributed and connected to allow stable populations of fish, reptiles, and amphibians to persist within their natural ranges. Natural reproduction of fish is not limited by habitat condition.

Monitoring Conducted

Water Resources Monitoring of Timber Harvest

Land use practices such as timber harvest have the potential to impact water resources through the introduction of fine sediment which associated with runoff from disturbed project sites. Measures which reduce the potential for impact have been identified and adopted in the Forest Plan and the Minnesota Forest Resources Council (MFRC) voluntary guidelines. These measures include the potential use of filter strips, set-backs from open-water resources, management of slash, seasonal limitations on activity, management of logging traffic, and design of crossings. Understanding the ability to apply these measures and their effectiveness is important for management. During 2008, Forest monitoring personnel conducted site visits to 14 timber harvest areas to evaluate compliance with guidelines provided in Voluntary Site-level Forest Management Guidelines (MFRC, 2005).

Evaluation and Conclusions

Stream Monitoring Reaches

The results of the “Wohlman” pebble count method used to characterize the bed material sediment are provided in Table 2.1. This shows there was a change in the material at five of the six sites that were monitored. Two sites were characterized as having finer bed material while four sites were characterized as having coarser bed material. There were no large-scale changes in the watershed or changes in the stream reach hydraulics. The differences between the two years appear to be a result of a combination of natural variability in the sediment supply and transport characteristics and uncertainty in the field method. It is important to understand the limitations and sources of error associated with field techniques to ensure changes in stream characteristics are not inappropriately attributed to management activities within the watershed.

Stream Crossing Surveys, Restoration Projects, and Monitoring

Twenty-four (approximately 11%) of the crossings inventoried in 2008 were considered to be a potential issue for aquatic organism passage. Over the last several years 916 crossings have been inventoried, with 106 crossings (approximately 12%) considered a potential problem for aquatic organism passage (Figure 2.1). These problem sites will be targeted for culvert replacement or modification as appropriate. Since 2005, 21 road crossings have been modified to accommodate aquatic organism passage.

Lake Water Chemistry and Mercury in Fish/Lake Water

Eleven lakes were sampled by the Minnesota Pollution Control Agency (MPCA) in 2008. The location of the lakes and data collected is shown in Figure 2.5 and Table 2.2. These lakes will also be sampled in 2009. The data collected are stored in the Environmental Protection Agency (EPA) database STORET. It can be accessed via the MPCA web site at: http://www.pca.state.mn.us/data/edaWater/index.cfm. These data are valuable for understanding trends, identifying trophic classification (including concentrations of phosphorus), physical traits of the lake (such as stratification by measuring lake temperature profile) and providing some limited insight into internal and external nutrient loadings. All of these lakes have aquatic consumption advisories due to the presence of mercury. The sources of the mercury are from off the Forest including intercontinental air-borne sources, most notably, power plants.

Young and Open Upland Coverage

A detailed analysis on the effect of vegetative treatment on a watershed was done for the Cascade project in 2008 (Figure 2.6). The proposed treatments will not result in exceeding the 60 percent upland young and open coverage at the Hydrologic Unit Code 6 (HUC6). This has been the case for all vegetation projects analyzed to date on the Superior National Forest (Figure 2.7). The coverage is continually updated with the "aging" of stands from estimated stand origin dates, the addition of young and open upland, the resetting of stand origin date associated with disturbance events such as fire and blowdowns and the estimation of activity in non-federal lands.

Water Resources Monitoring of Timber Harvest

Timber harvest units that were monitored were derived from a pool of candidate sites harvested (or final treatment conducted) during the past four years. The selection was driven by the units containing or adjacent to wetlands, streams or containing Ecological Land Types (ELT) 1-6. These six ELTs describe differing conditions of lowlands including ELT 1-4 which typically possess hydric soils, wetlands, and/or riparian areas. Water resources such as these are functionally linked to adjacent uplands and many forest invertebrate and vertebrate species are influenced by site level activities. Best Management Practices (BMP's) (Figure 2.8) were developed lessen the disturbance to these unique land features.

Fourteen sites were visited. There was little evidence of negative impacts upon most water resources. Generally most sites visited were well mitigated to protect water resources and ameliorate any temporary effects resulting from silvicultural activities. There was no evidence of sustained sedimentation into wetlands or riparian areas despite

logging disturbance in these areas. More detailed information can be found in the Monitoring Project File.

B. REFERENCES

Minnesota Forest Resources Council. 2005. Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines. Minnesota Forest Resources Council, St. Paul, MN.

Table 2.1. Stream bed material sediment results from monitoring on the Superior National Forest (Wolhman Counts).

Stream Name	Initial Data Year	D50[1] in 2008 (mm)	D50[1] in 2008 (mm)	Change in AGU[2] Classification	Comment
Kadunce	2005	30	3	Coarser	No real change-coarse gravel
Hill Creek	2006	87	58	Coarser	Change from gravel to cobble bed-possibly a different location
Nester Creek	2005	31	31	Coarser	Change from sand to gravel bed
Little Isabella River	2006	64	19	Coarser	Very coarse gravel
Trappers Creek	2006	0	0	No Change	Should not use Wohlman Method-possibly a different location
Sphagnum Creek	2006	21	(164)	Finer	Change from cobble to gravel bed

1. Median particle diameter
2. American Geophysical Union

Table 2.2. Minnesota Pollution Control Agency lake monitoring on the Superior National Forest (STORET database).

2008 MPCA Lake Monitoring on the Superior National Forest

Lake Name	DNR ID No.	No. Of 2008 Observations	Depth Integrated										Comment
			Chl-a	D.O.	TKN	NOx	pH	Pheo	TP	TSS	Temp	Secchi	
Bear Isand Lake	69-0115	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Birch Lake	69-0003	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Elephant Lake	69-0810	13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Fall Lake	38-0811	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Lake Vermillion	69-0378	9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Northern Light Lake	16-0089	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Shagawa Lake	69-0069	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	29 years of
Tait Lake	16-0384	5										✓	
Trout Lake	16-0049	no data entered in STORET											
Whiteface Reservoir	69-0375	29										✓	20 years of data
Wolf Lake	69-0143	no data entered in STORET											

Figure 2.1. Coarse level culvert survey locations completed in 2008 on the Superior National Forest.

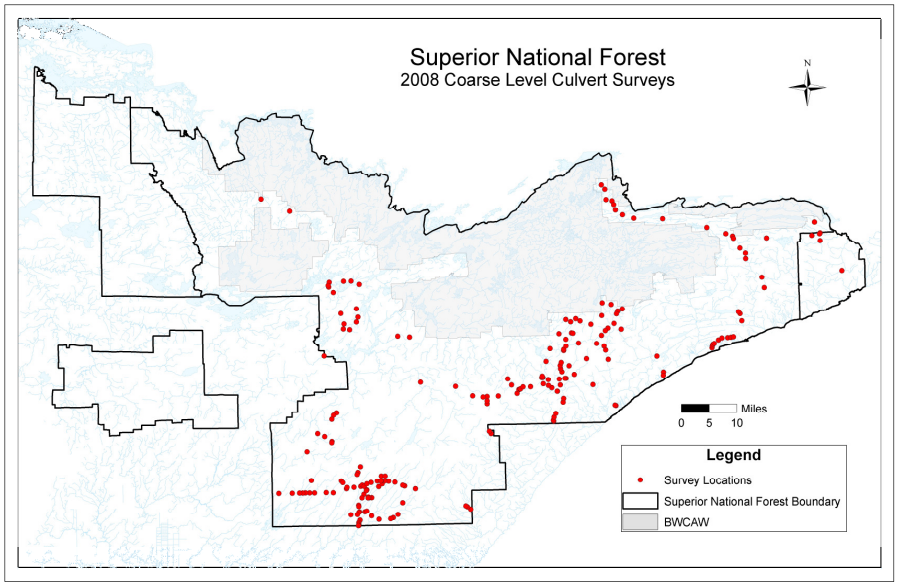

Figure 2.2. Stream monitoring locations for 2008 on the Superior National Forest.

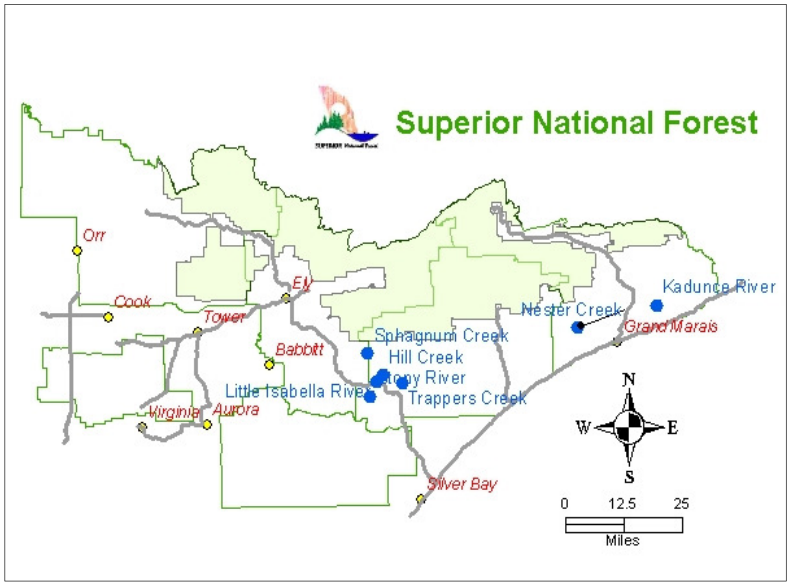

Figure 2.3. Joint fire science program lakes between the Minnesota Department of Natural Resources and the Forest Service within the Superior National Forest.

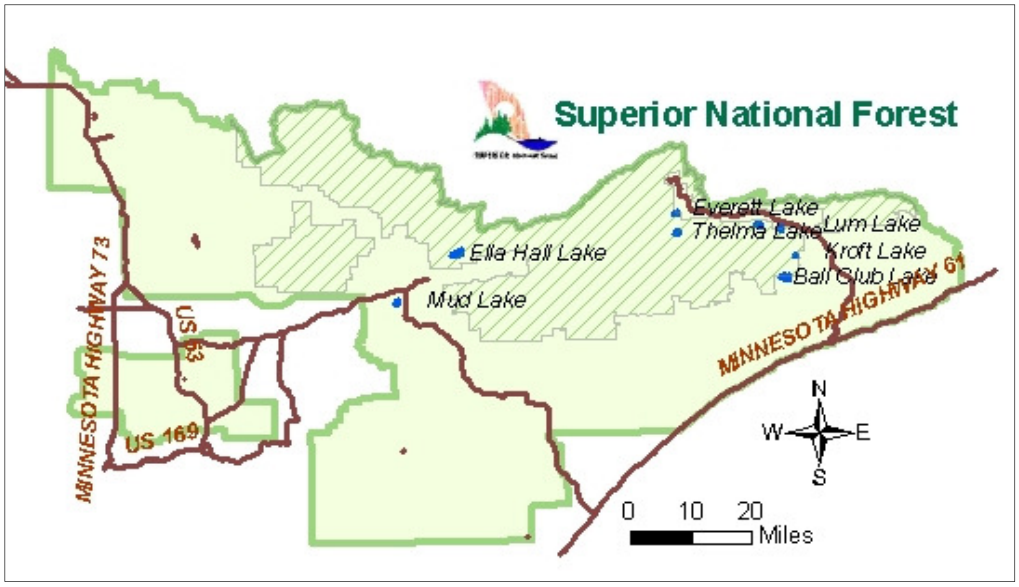

Figure 2.4. Modified road crossings on the Superior National Forest since 2004.

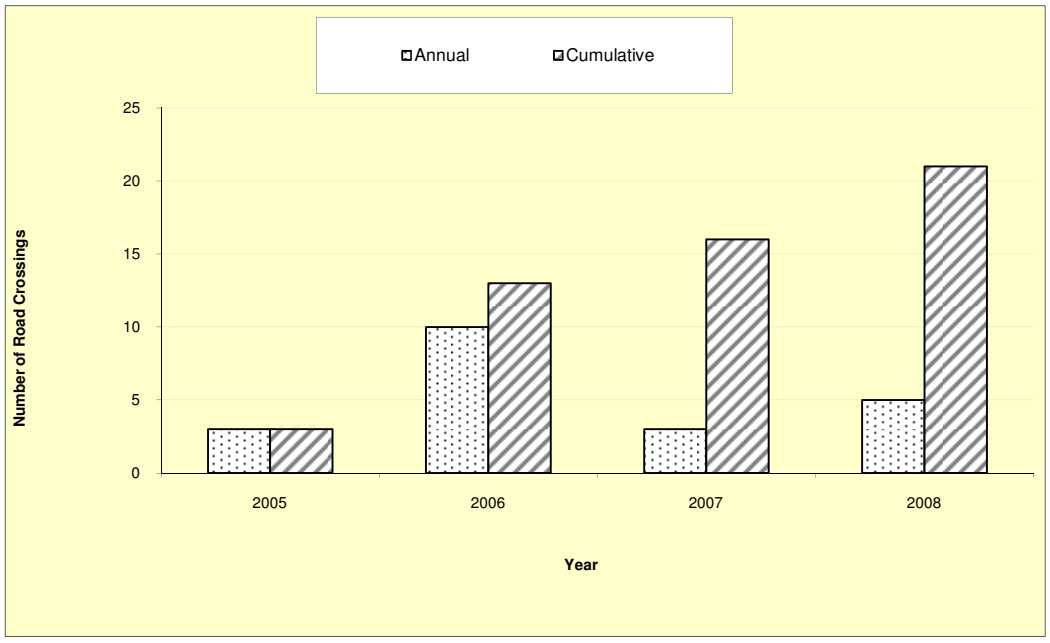

Figure 2.5 Minnesota Pollution Control Agency 2008 lake monitoring locations on the Superior National Forest.

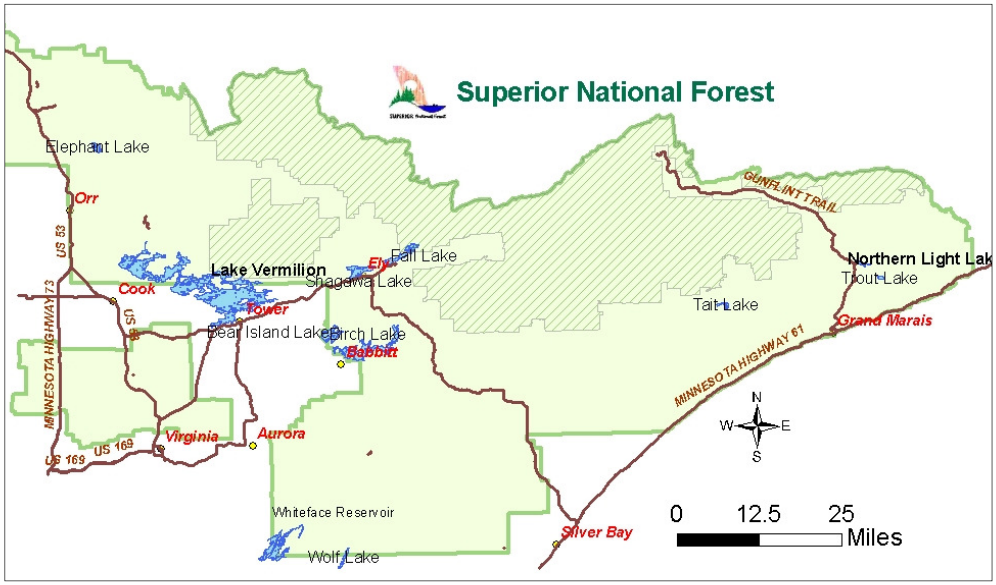

Figure 2.6. Cascade project Hydrological Unit Code (HUC) 6 analysis area on the Superior National Forest.

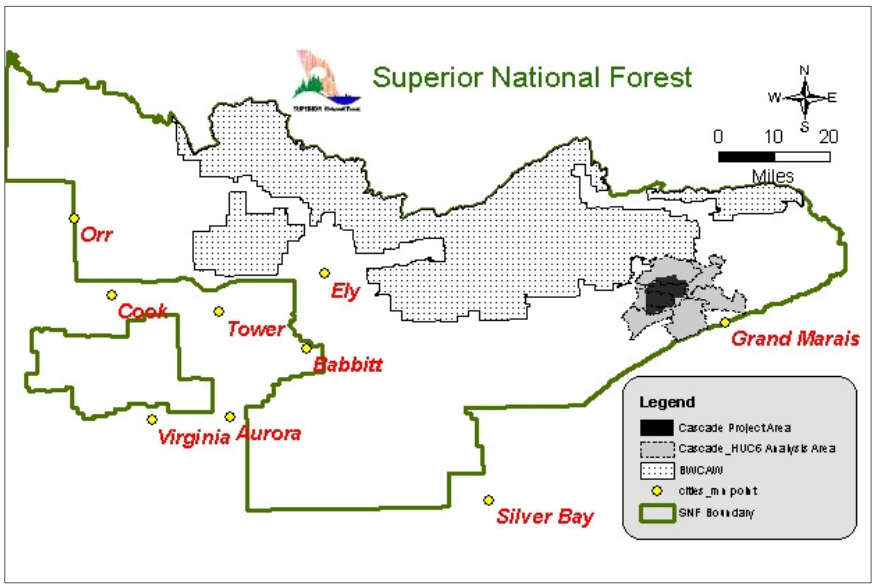

Figure 2.7. Hydrological Unit Code (HUC) 6 watersheds analyzed from 2004 through 2008 on the Superior National Forest.

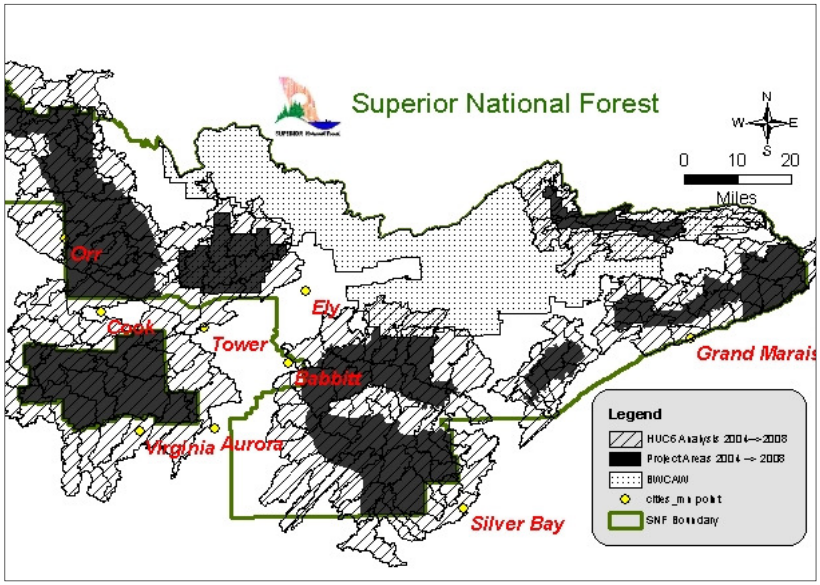

Figure 2.8. Dumbell River area within the Superior National Forest where Best Management Practices were used to capture debris and slow water flow.

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